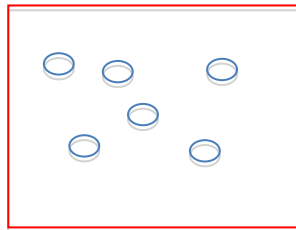


## Freezing (Plaster) - Student Activity

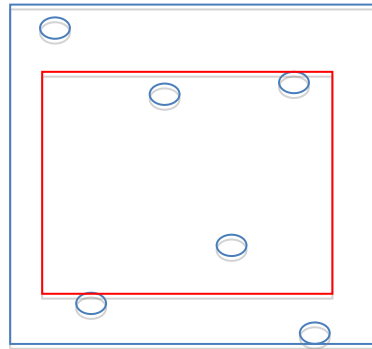
Most substances contract when they cool. Water is different. It expands on cooling. Its particles are more spread out. The same volume (amount of space) contains less water. We call this a decrease of density.

In the diagrams below the dots represent particles of water.

Space taken when frozen →



Warm water



Frozen water

There is less water in the same volume when water freezes. This explains why ice floats on water.



In cold northern countries frost wedging is used to break up rocks in quarries. Thin groves would be cut into the rock and filled with water. Overnight expanding ice would widen and deepen the grooving. The process would be repeated until the crack was sufficiently large to break off a block of rock. We are going to test this idea.

Scientific data for a “fair test” must be:

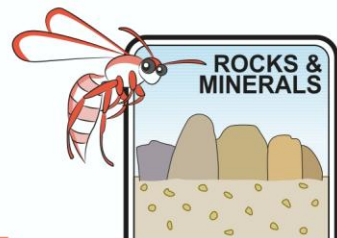
O \_\_\_\_\_

M \_\_\_\_\_

R \_\_\_\_\_

Before it is

R \_\_\_\_\_



## Freezing (Plaster) - Student Activity

Materials required per student or group:

- 2 clean and empty 1L milk cartons cut in half (only bottom half needed)
- 1 balloon
- A mixing bowl
- 1 spoon
- About 12 tablespoons of Plaster of Paris (A beautiful white outcrop of gypsum is near Montmartre in Paris – hence the common name).

1. Fill the balloon with water until it is about the size of a ping-pong ball. Tie it off.
2. Place the water filled balloon into one carton
3. Place the Plaster of Paris (calcium sulphate,  $\text{CaSO}_4$ ) in the bowl and mix in sufficient water until it has the thickness of custard or yoghurt.

Write the word equation for what has happened with the plaster of Paris and water. Label the reactants and product in the reaction

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Is this a chemical reaction or a physical reaction? \_\_\_\_\_

4. Drop two tablespoons of plaster into the bottom of the carton. Place the balloon onto this and hold in position with two fingers. Add more plaster until the balloon is just covered. Keep fingers on the balloon until the plaster starts to firm (about 3 minutes) then remove fingers and smooth over with a little of the remaining plaster.
5. Leave until the plaster has become hard. It may be necessary to hold down the balloon while the plaster sets
6. Place both half cartons in the freezer overnight. Water in the balloon will have expanded on freezing and have cracked the plaster.
7. Remove and observe

What happened to the blocks of plaster?

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Why was the block without the balloon included in the experiment?

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